



Hiroshima / Fukushima: Gender Matters in the Atomic Age

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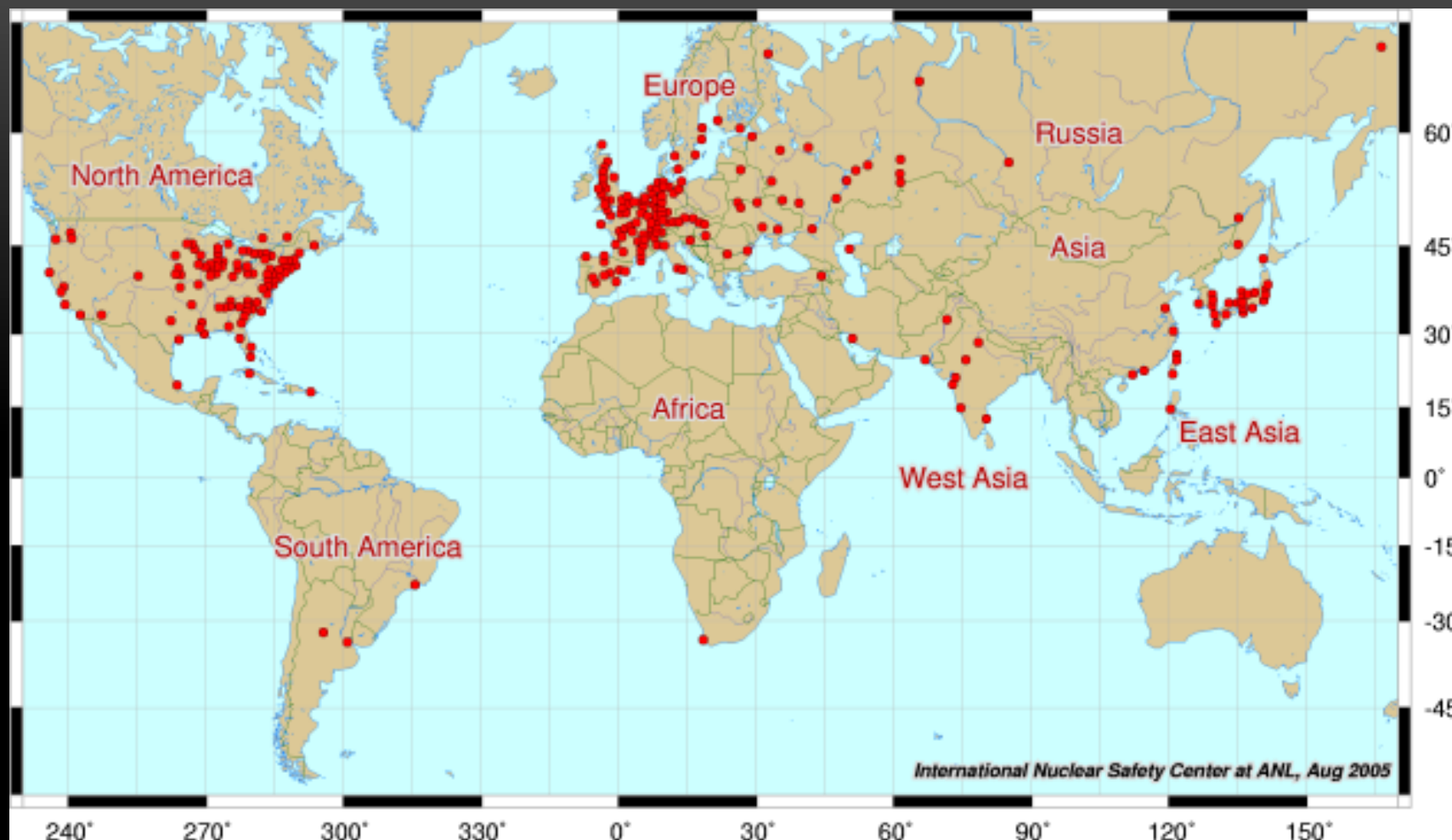
Presentation posted: <http://tinyurl.com/Olson2016>

Original paintings by Loren Olson

Silhouette figures by Saro Lynch-Thomason



Nuclear Power Stations: In 2015 there were 391 operable reactors worldwide

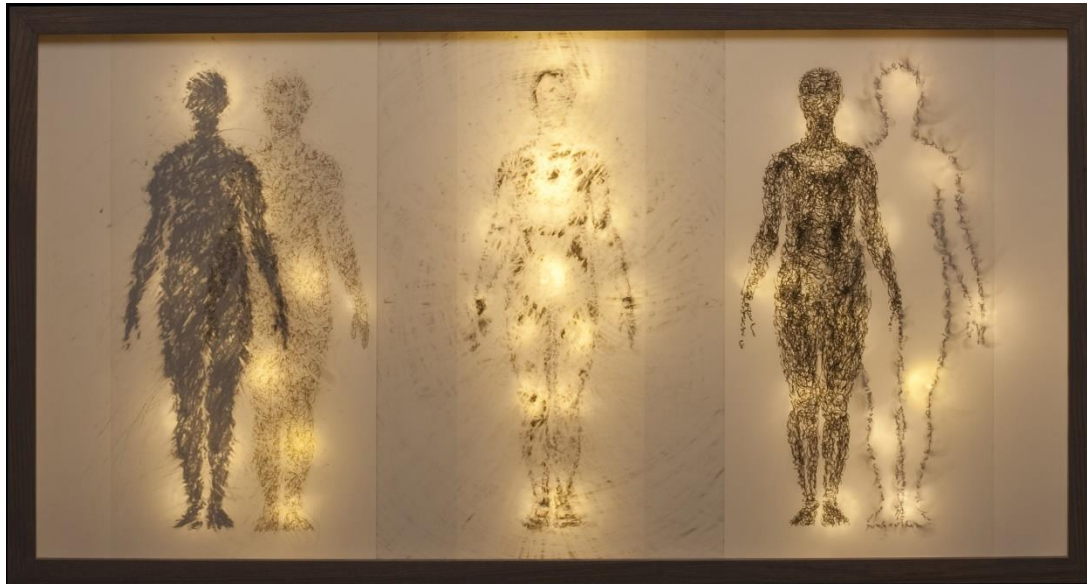




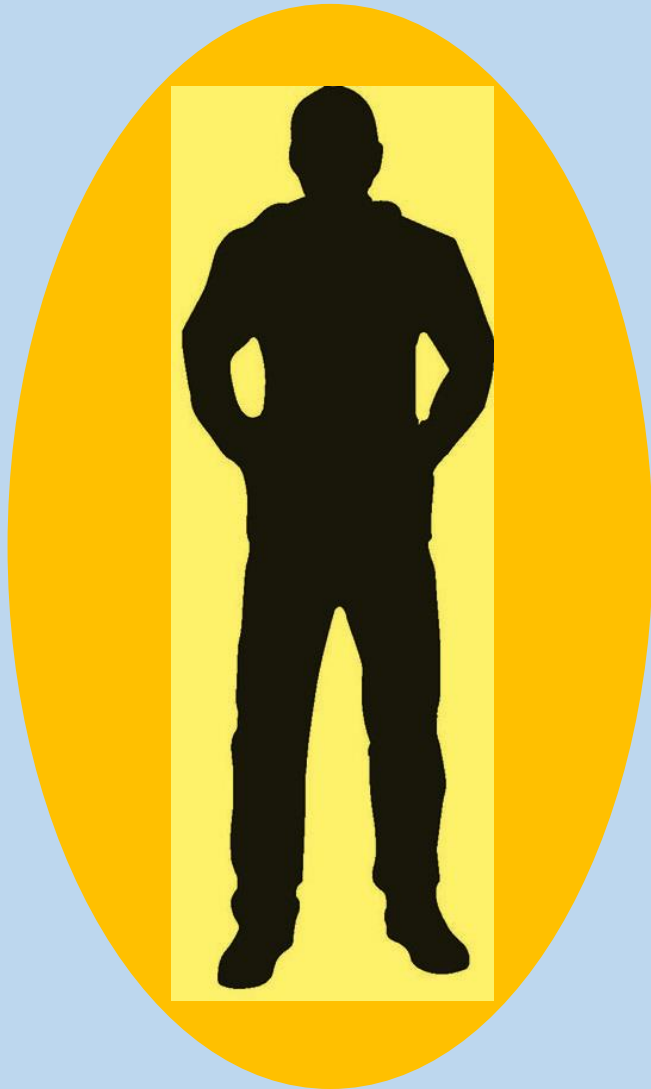
Chernobyl (1986), Fukushima (2011)



I will speak of our human lifecycle—however
radioactivity also impacts all life on Earth



Radiation regulation has been based on
“Reference Man”



Policy is a decision

When a dangerous industry is regulated, policy-makers decide how many deaths are “OK.”

1 cancer in a million people exposed is often the goal.

Regulation of public (lifetime) exposure to ionizing radiation **starts** at 1 fatal cancer in 286 = OK. This assumes male adults.

If the goal were 1 cancer in 1 million baby girls, then industrial nuclear operations would have to cease and sites would be CLEANED UP!



Source: Mary Olson, unpublished calculation



Ionizing Radiation: No Safe Dose

- All regulatory agencies acknowledge that every exposure to ionizing radiation carries risk of harm:

There is no “safe” dose of ionizing radiation:

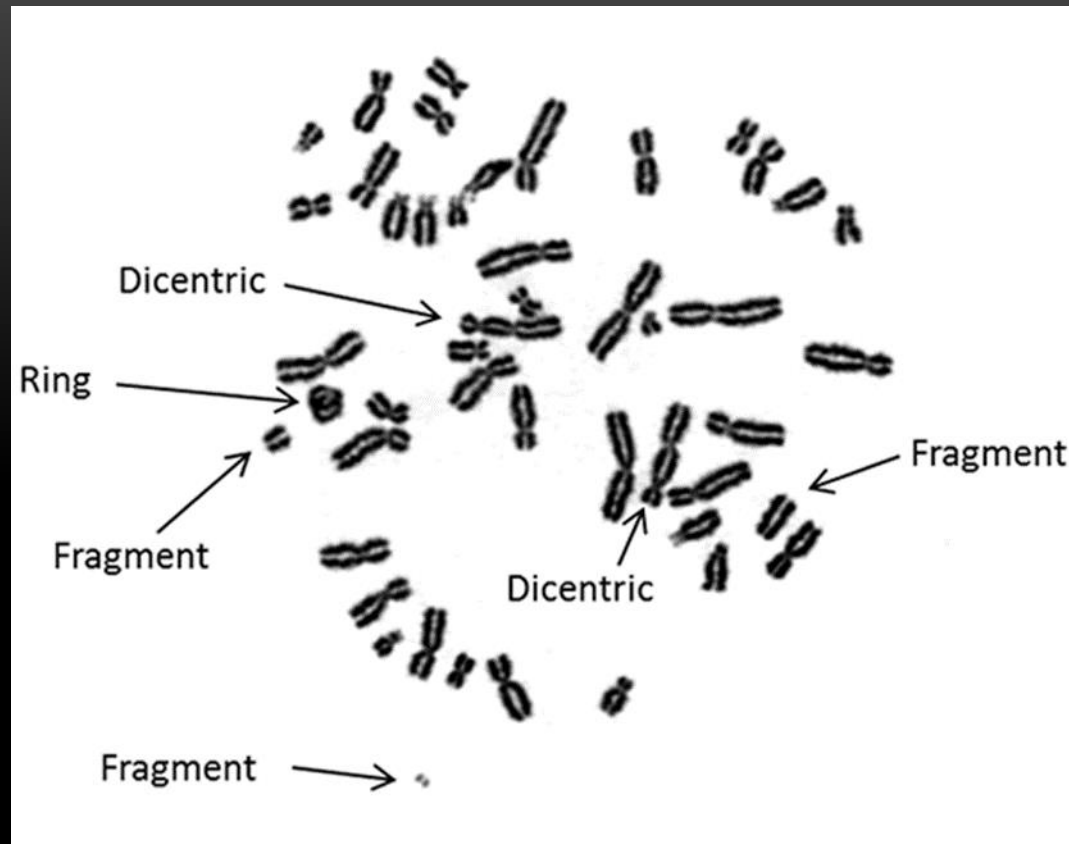
It is not safe for adult males.

Recent findings:

Ionizing radiation is even less safe for children and for females.



Radiation Induced Chromosomal Aberrations, as seen with microscope

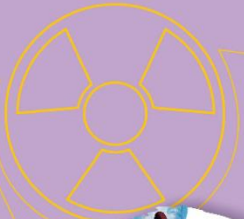


RADIATION AND HEALTH

Radiation is different from any other poison.



Radioactivity lasts for many thousands of years. If it gets into the land, water, plants and animals, it might be too dangerous to go there, to hunt, or to collect tucker for many generations.



IT BREAKS THE STORIES OUR BODIES HOLD THAT KEEP US HEALTHY. DAMAGED STORIES CAN BE PASSED ON TO OUR CHILDREN.

Radiation causes cancer. The most common cancers caused by radiation are cancer of the thyroid, breast, lung and blood. Sometimes it can take many years before the cancer grows.



In a nuclear reactor, radioactivity is increased a million times.

Uranium in the water can cause kidney damage.

Mining uranium increases people's exposure to radiation.



There is no safe dose of uranium.



URANIUM leave it in the ground



Produced by the Australian Nuclear Free Alliance with support from the JB Seed Fund. Contact: Friends of the Earth, jim.green@foe.org.au, ph 0417 318368

RADIATION HAS INTERGENERATIONAL CONSEQUENCES

IT BREAKS THE STORIES OUR BODIES HOLD THAT KEEP US HEALTHY. DAMAGED STORIES CAN BE PASSED ON TO OUR CHILDREN.

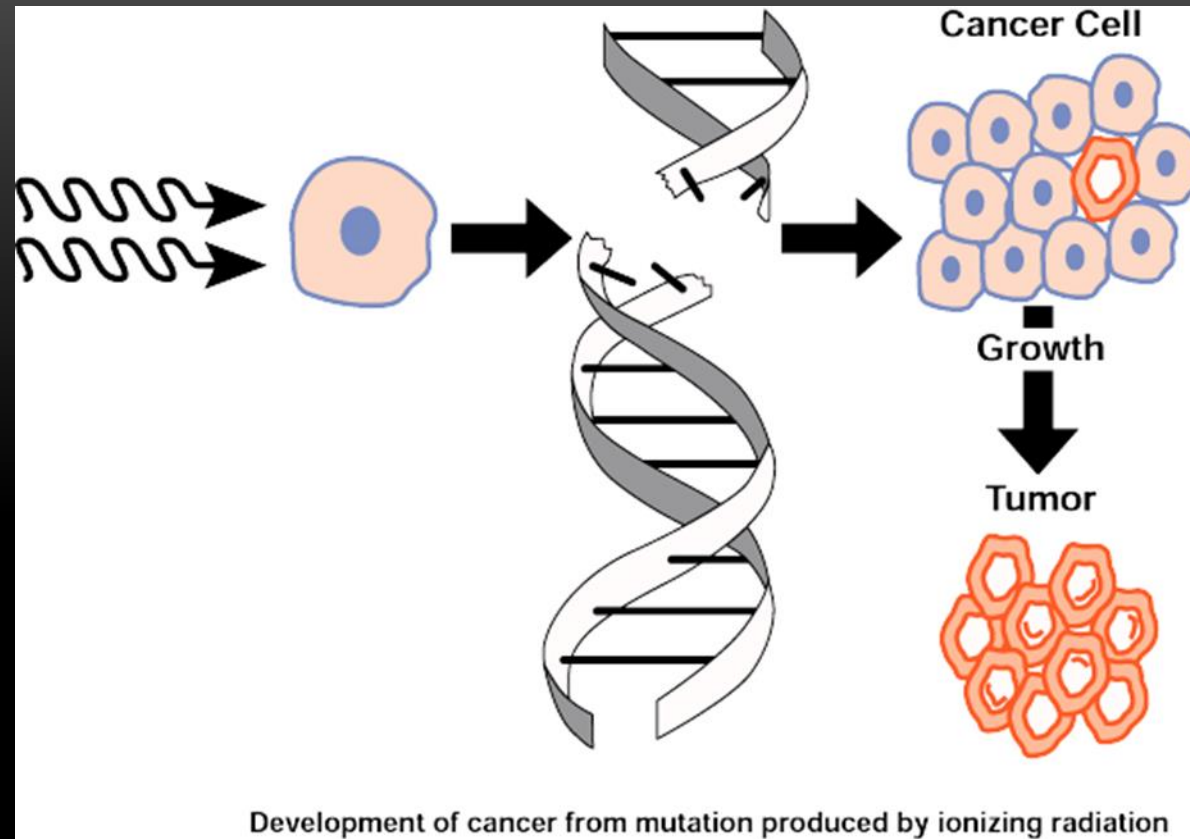


Ionizing Radiation: Non-Cancer Medical Impacts





Medical Impacts of Ionizing Radiation: Cancer



Ionizing radiation harms our cells.

Data Sets

Because non-lethal exposures to ionizing radiation may or may not result in harm...

And because harm that is cancer takes many years to appear... and cancer is caused by many other things...

A large number of people, with radiation exposure tracked for a period of time is required for research.

This is called a data-set.

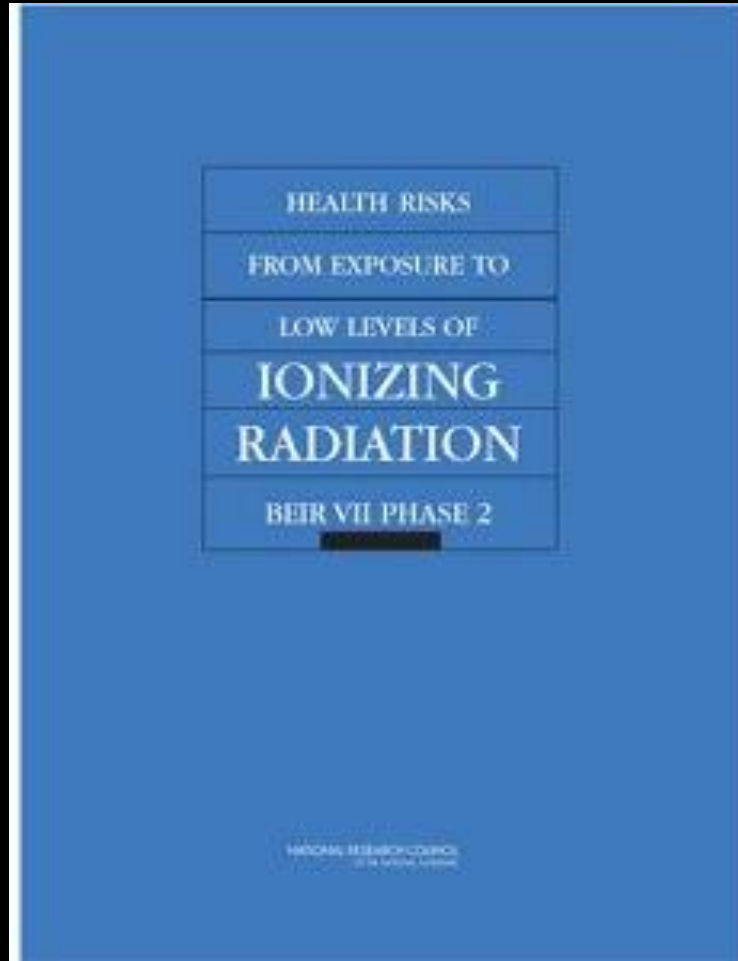




Radiation is more harmful to children



Children Between Birth and 5 Years



U.S. National Academy of Science:
Biological Effects of Ionizing Radiation (BEIR VII Phase 2)
published 2006.



Survivor Lifespan Study

- Data recording (ABCC) began in 1950. Deaths between 1945 and 1950 were not recorded.
- Survivors were strong; stronger than a typical population.
- Survivors (more than 90,000) were grouped by the age that they were at the time of the bomb.
- Cancers, and cancer deaths, were counted in these groups.
- In 2006 the first 60 years of data was published (BEIR VII)



Lifetime Risk of Cancer Incidence (acute exposure between birth and age five)



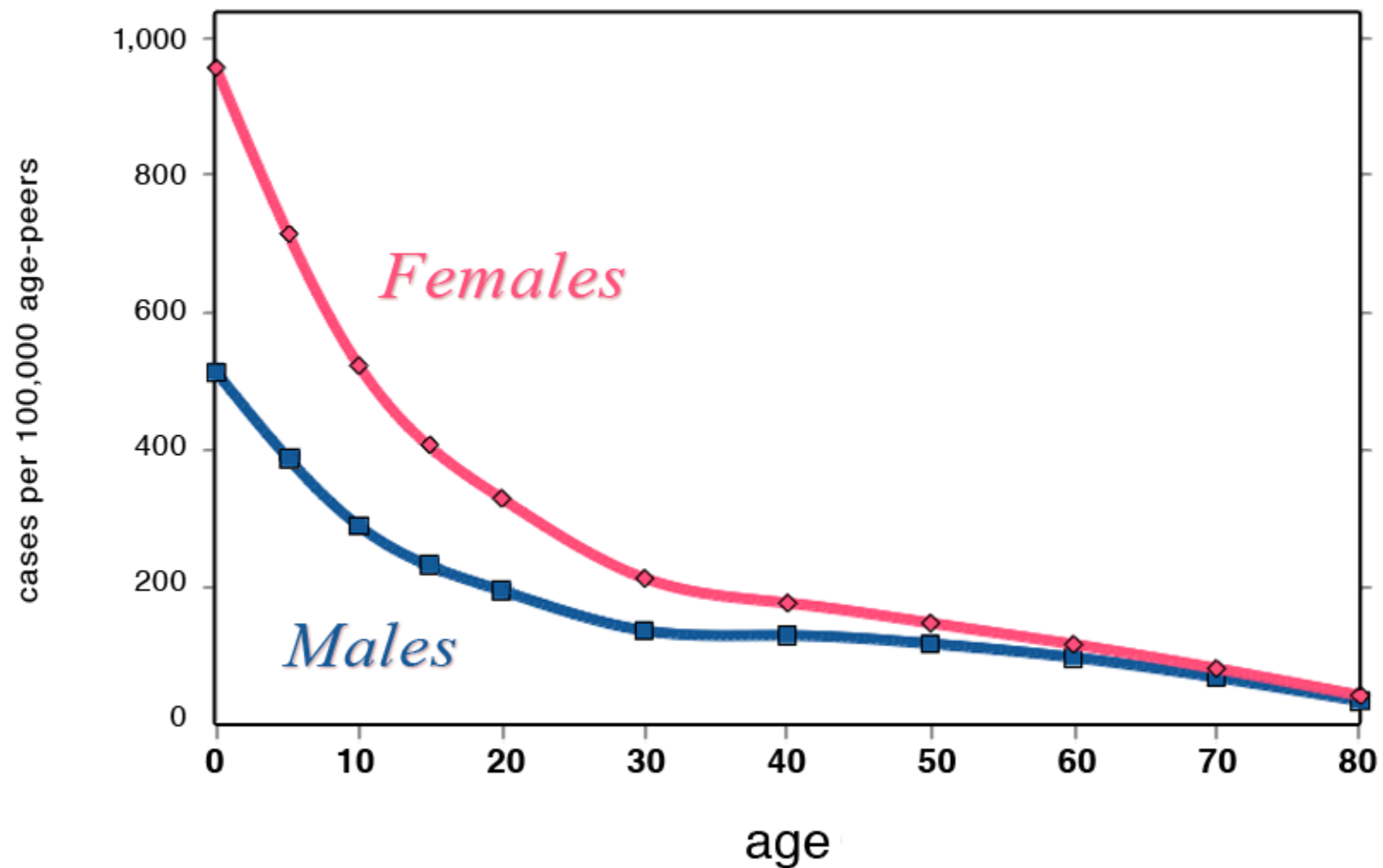
2 Boys



4 Girls

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation

Acute exposure (one time)

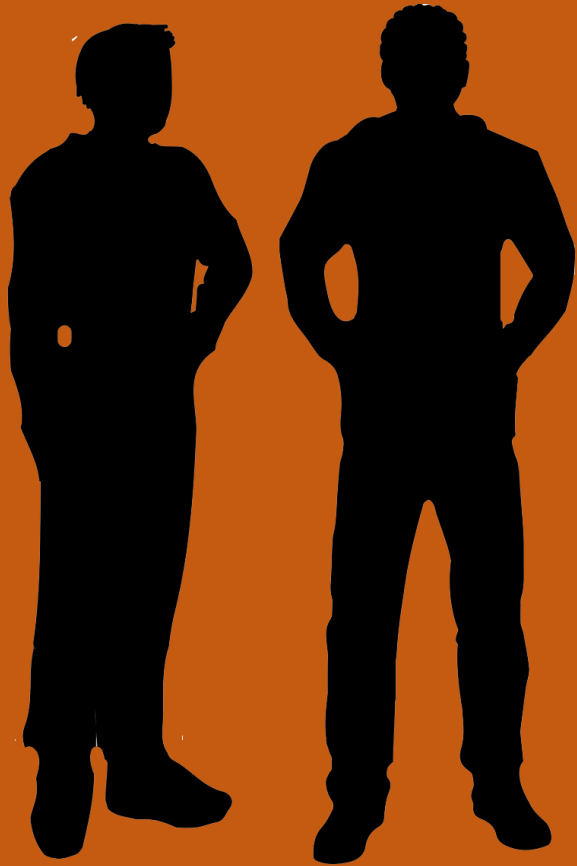


Data Source:

U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model



Lifetime Cancer fatalities among those exposed to ionizing radiation as adults



2 Men



3 Women

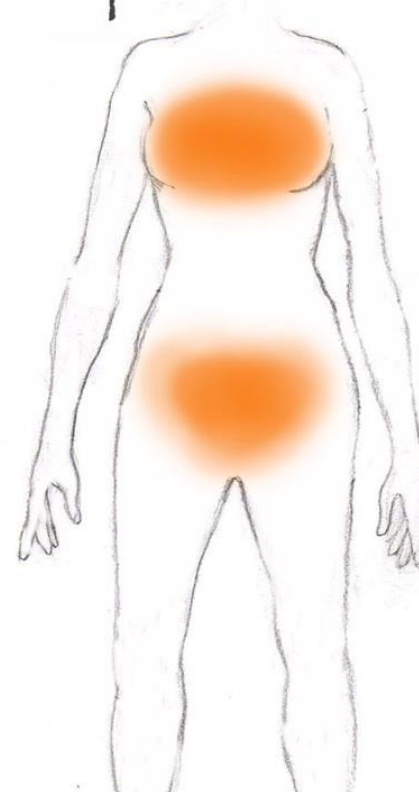


Why is Gender a risk-factor for more cancer?



Dr. Rosalie Bertell

Females have 50% more
high-risk tissue
compared to males

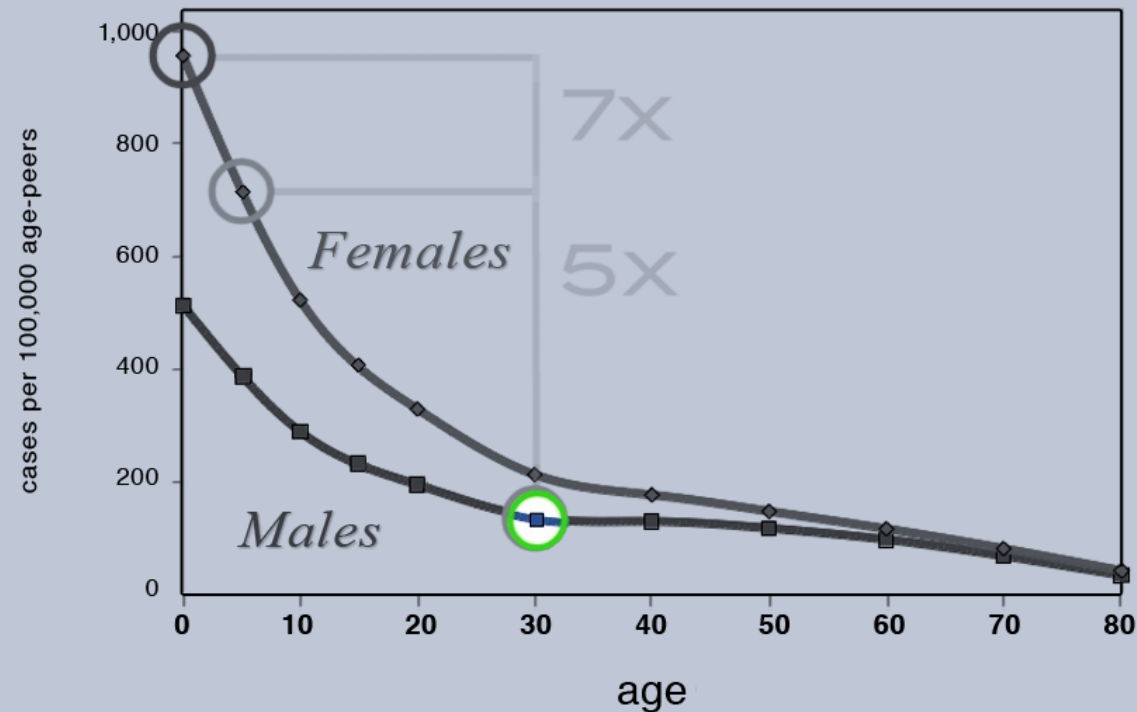




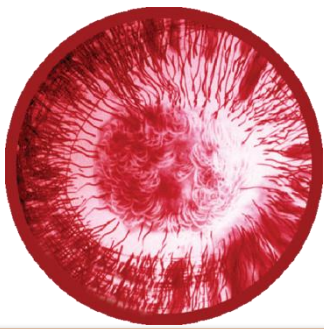


Green circle = VISIBLE in radiation policy decisions
Gray = INVISIBLE

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation
Acute exposure (one time)



U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model



Hiroshima and Nagasaki are unique;
not conservative

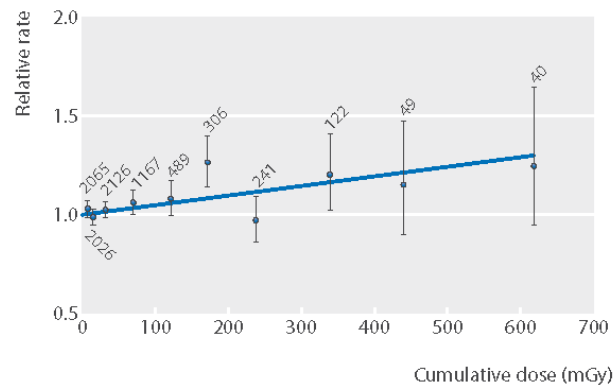


- Deaths that came after the blasts, between 1945 and 1950 not included in data;
- Survivors studied 1950 -- 2005 are STRONGER group than any “general population”



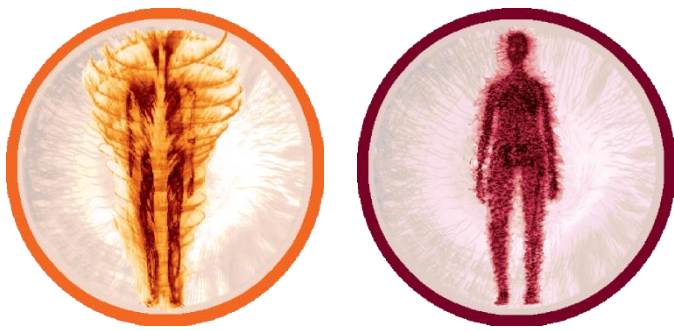
Risk of cancer from occupational exposure to ionising radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS)

David B Richardson,¹ Elisabeth Cardis,^{2,3,4} Robert D Daniels,⁵ Michael Gillies,⁶ Jacqueline A O'Hagan,⁶ Ghassan B Hamra,⁷ Richard Haylock,⁶ Dominique Laurier,⁸ Klervi Leuraud,⁸ Monika Moissonnier,⁹ Mary K Schubauer-Berigan,⁵ Isabelle Thierry-Chef,⁹ Ausrele Kesminiene⁹



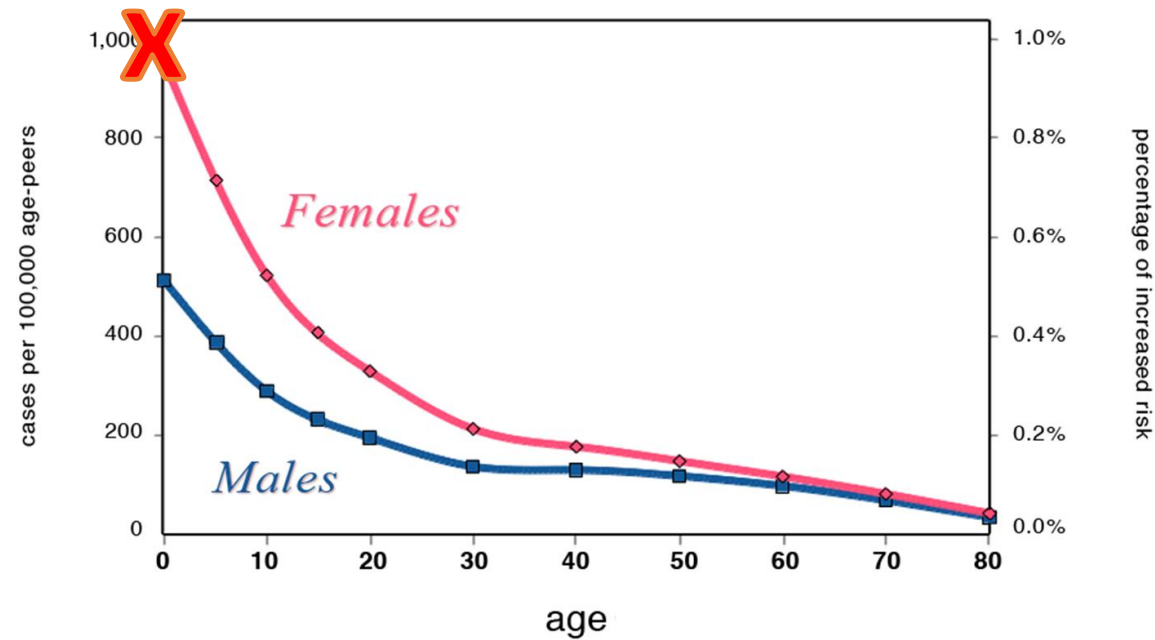
Relative rate of mortality due to all cancer other than leukaemia by categories of cumulative colon dose, lagged 10 years in INWORKS. Vertical lines=90% confidence

- **“Study question:** Is protracted exposure to low doses of ionizing radiation associated with an increased risk of solid cancer?”
- “Although high dose rate exposures are thought to be more dangerous than low dose rate exposures, the risk per unit of radiation dose for cancer among radiation workers was similar to estimates derived from studies of Japanese atomic bomb survivors.”

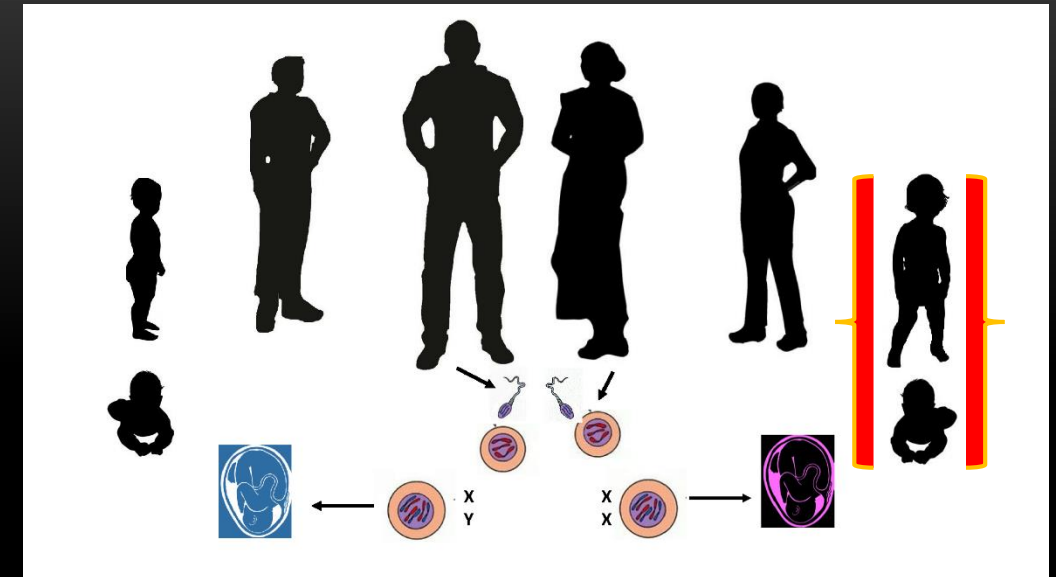


Responsible radiation regulation: Life Cycle Protection

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation
Acute exposure (one time)



U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model



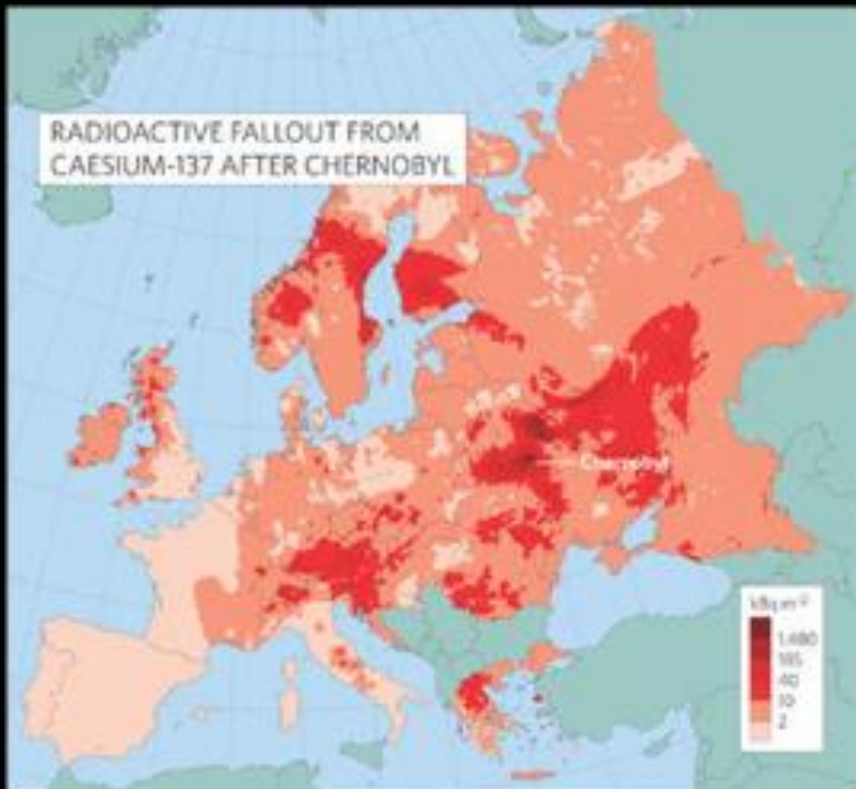


Radiation Exposure in Pregnancy: Three Generations





Environmental Contamination: Chernobyl and Fukushima



40% of Europe contaminated above 4,000 Bq / m²
by Chernobyl reactor explosion in 1986



Gamma levels in proximity to Fukushima Daiichi, map
constructed by Lionel Bergeret from SAFECAST data

Lifetime exposure

EXAMPLE (not observed)

20 mSv a year for
70 years

US Nuclear Regulatory
Commission predicts:

Cancer death = **1 in 7**

["Reference Man"]

Male lifecycle adjusted:

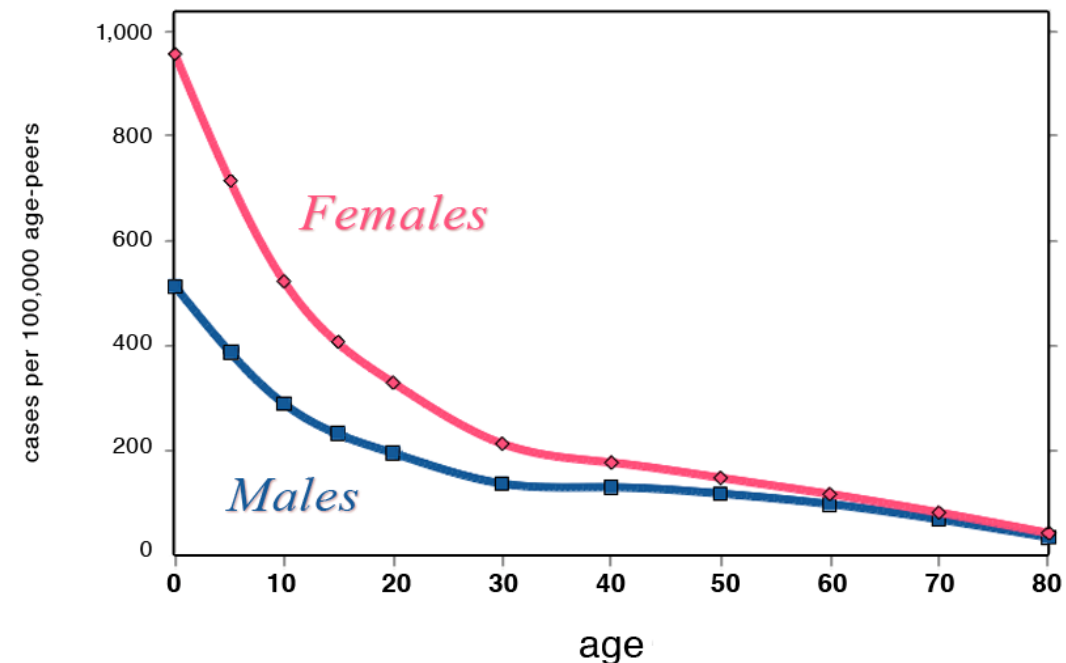
Cancer death = **1 in 5**

Female lifecycle adjusted:

cancer death = **1 in 3**

This graph is based on a one-time exposure
to 20 mSv (acute) radiation [BEIR VII]

Increased Cancer Risk by Age at Exposure to 20 mSv Radiation



U.S. National Academy of Sciences BEIR VII Phase 2 Risk Model

Source: preliminary calculations by Mary Olson

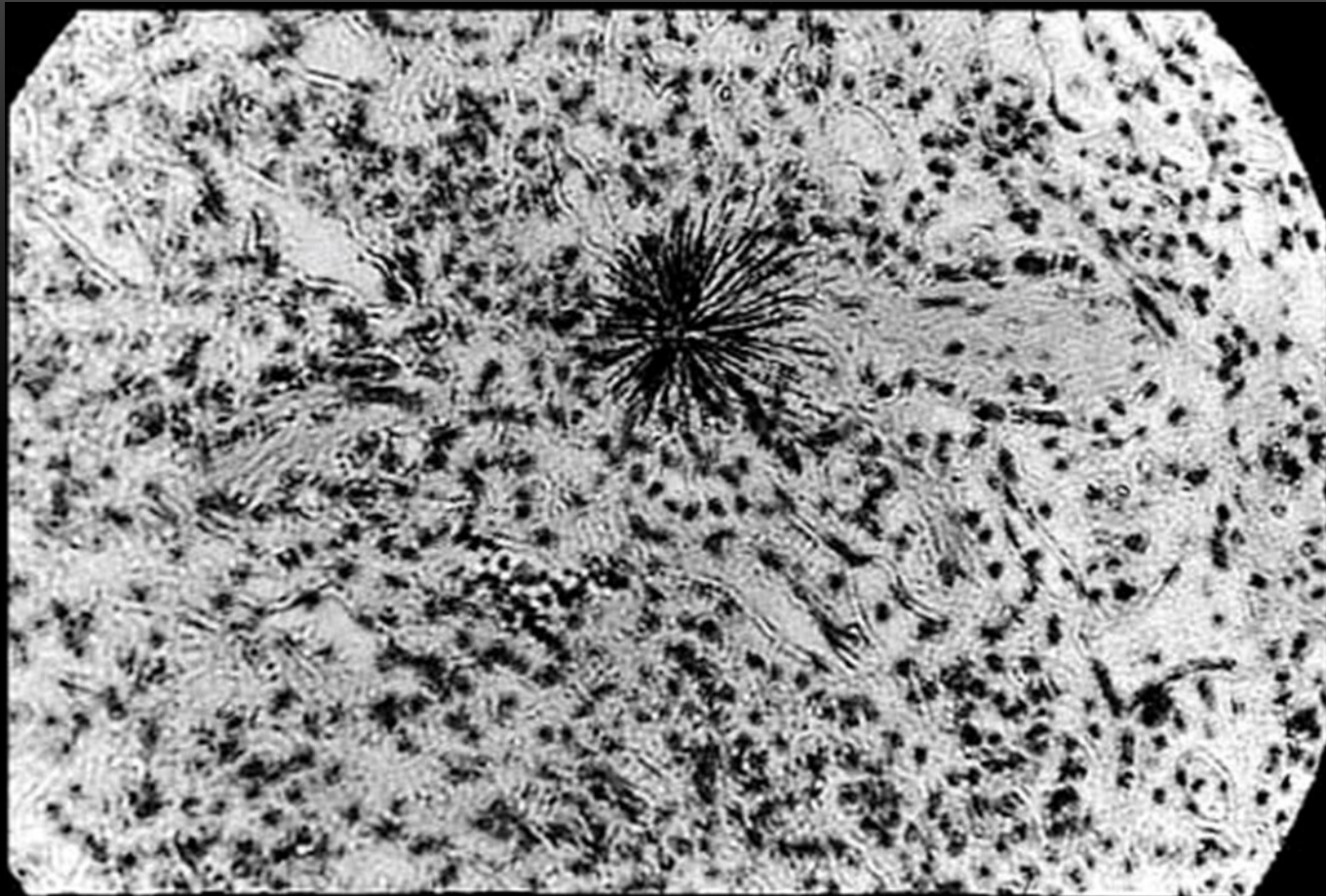
Diaspora

- Definition: the dispersion of any people from their original homeland.
- There is no moral ground in which to require people to stay in their homes after a meltdown. These communities have become Diasporas:
 - Harrisburg... [Three Mile Island]
 - Pripyat... [Chernobyl]
 - Futaba, Namie, Tomioka... [Fukushima]

A Diaspora is not a good “data set.”



Visible damage from Plutonium emitting alpha radiation in lung tissue

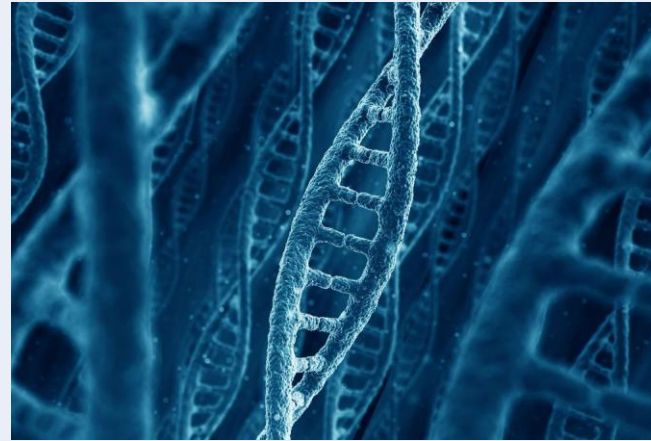
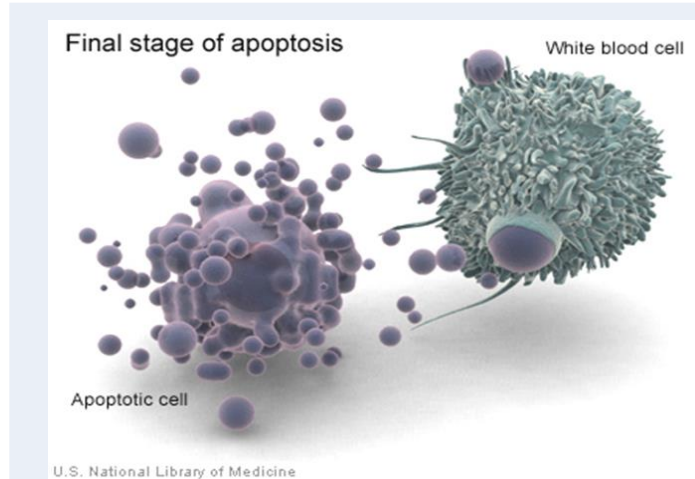


Dr Donnell Boardman:

Radiation is a physical event

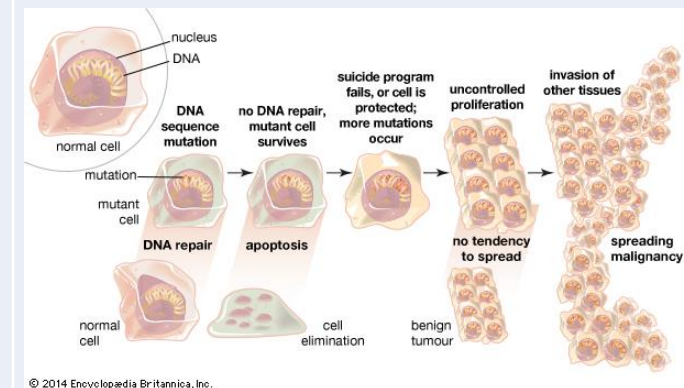
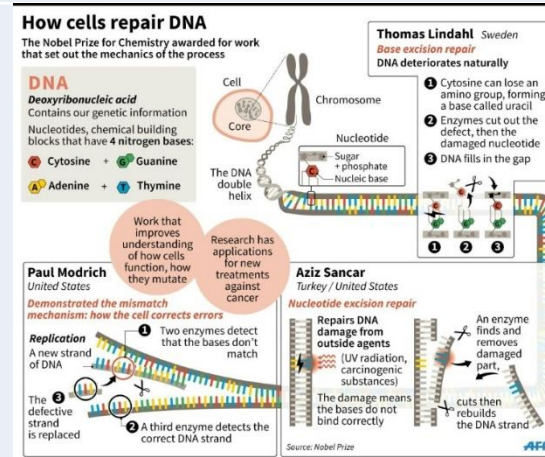
- Every radiation exposure is unique;
- An exposure so small it cannot be measured may still result in cancer;
- Radiation is a PHYSICAL event, and like any collision, no two are exactly alike;
- The body's repair mechanisms are miraculous, but not perfect;
- Imperfect repairs may result in cancer (out of control cell reproduction).

Internal exposure outcomes:



What type of radioactivity?
Where in the body does it concentrate?
How long does it stay in the body?

Alpha, beta, gamma are all more damaging when emitted inside our body.



Dr. Dennis Nelson: “DOSE” is not accurate

- The concept of a “dose” is based on toxic substances that can be diluted to the point where they are not toxic.
- Radiation is not like poison. It is a physical event that results in physical damage.
- Now we know that bodies are not the same. Age, gender, genetic factors can all influence the outcome of a radiation exposure.
- A “Rem” or Sievert” does not describe the complexity of radiation harm.

Bio-Accumulation

Aquatic food-chain

Concentration of heavy metals (including many radionuclides) is higher in larger fish since each step in the chain has a higher concentration than the one below.

Tritium is radioactive hydrogen and while it does not concentrate, tritium goes anywhere in the body that water goes, including across the placenta.

